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TITLE: STORAGE BATTERY STATE DETECTOR

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**Abstract Text ~ FPAR (1):**

PURPOSE: To detect the sign of the dry up of a sealed lead storage battery so as to prevent the breakage of a battery circuit by inserting the electrode at the lower part of the metallic rod covered for insulation to the bottom of a battery jar, and connecting the terminal at the top to a detection circuit.

**Abstract Text ~ FPAR (2):**

CONSTITUTION: A metallic rod is covered with insulating material, and a tip exposed section is provided with an electrode 2, and the other end is provided with a terminal 4. The insulating cover of this electrode body is covered with a tubular object, and a slit is provided in the position which covers the electrode at the tip. This electrode body is inserted to the bottom of a group of electrode plates 11 within the battery jar 12 of a sealed lead battery. Next, a detection circuit 10 equipped with a light emitting diode 10A and a current reducing resistor 10B is provided between the above terminal 4 and the terminal 9 lower in potential than the cell inserted in the electrode body. This detection circuit 10 detects that the electrolyte which shows the level L1-L3 at the initial stage of use decreases to the level of about L4, and that it falls to the specified voltage or under or reaches zero potential.

## [Claim(s)]

[Claim 1]An electrode and the other end are constituted for a tip exposed part of a metal stick by which pre-insulation was carried out as a terminal area, A tube-like object connected with pre-insulation from a pre-insulation tip perimeter end is made to hang to a position which covers an electrode, Are the electrode body which provided a slit in said tube-like object flank, and said electrode body is inserted to a polar-plate group lower end part of a direct vent type lead storage battery, A storage battery state detection device characterized by providing a detector circuit between a terminal whose potential is lower than an electrode body insertion cell, and an electrode body terminal area, carrying out an alarm as a case where potential of an electrode body terminal area turns into a fall or non-potential from predetermined potential being unusual, and making it display as normal when higher than predetermined potential.

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## [Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to improvement of a method which detects the abnormalities of the battery in the use which uses them carrying out series connection of many direct vent type lead storage batteries (it is henceforth called a battery), such as an electromobile, at an early stage.

[0002]

[Description of the Prior Art]In the use which connects many batteries in series like an electromobile, and is used as grouped cells, if it is generated by a battery with little capacity, or the broken battery also in one cell in grouped cells, this battery may become a factor and may also intercept electric discharge or charge of grouped cells.

[0003]The device which supervises transition of the internal resistance of a battery is equipped, and if the voltage of beyond default value, at i.e., the time of electric discharge or charge, exceeds the range of default value, internal resistance takes out an alarm with an electromobile and he is trying to prevent battery failure beforehand with it, in order to prevent such an accident beforehand.

[0004]However, when the internal resistance of a battery begins to rise, it has the character to go up rapidly, and when a sensing device detects abnormalities, capacity recovery of a battery is difficult, and with the electromobile, the failures where a run on the street becomes impossible almost simultaneously with an alarm check are occurring frequently.

[0005]

[Means for solving problem]This invention perceived the isolation electrolysis solution in a direct vent type lead storage battery in order to solve the above-mentioned conventional problem. While the separator in a battery is an isolation board, it also has a function as an

electrolysis solution retainer board. Although the electrolysis solution separated in the state of neglect and electric discharge hardly exists, by the gas emitted between active materials at the time of charge, the electrolysis solution contained between active materials is breathed out very much out of a plates element, and the interval part of an element and \*\*\*\*\* is gone up.

[0006]The rise of this electrolysis solution is adjusting the amount of pouring in so that the electrolysis solution separated even if it was [ fault ] under charge may not become more than an element top end, in order to prevent \*\*\*\*.

[0007]However, since it becomes the same character as a liquid type battery between polar plates when this separated electrolysis solution exists so much, it is intercepted that the generating gas at the time of charge approaches a cathode plate by a solution layer, the gas absorption in a cathode plate becomes impossible, and generating gas is exhausted outside in the state of gas. As a result, isolation electrolysis solutions decrease in number with many years past, and the isolation liquid which appears in said interval part decreases in number gradually. Since gas absorption efficiency rises along with this, it becomes impossible to check isolation liquid except the time of fault charge.

[0008]If the electrolysis solution separated from between polar plates stops flowing out even if it is under charge, [ this invention ] It found out that it was a sign it becomes impossible to be equal to fault charge if the internal resistance of a battery also going up and calorific capacity's also becoming small and this time pass, If this state is detected and equalizing charge is carried out, capacity recovery is also possible, and if this time is detected, it is based on having found out that the accident in which a discharge circuit is immediately intercepted by the dry rise by rapid fault charge did not occur, either.

[0009]Namely, this invention storage battery state detection device carries out pre-insulation of except for a metal stick tip and the other end, The tube-like object which constitutes an electrode and the other end as a terminal area, and is connected with pre-insulation from a pre-insulation tip perimeter end in a tip part is made to hang to the position which covers an electrode, This electrode body is inserted in this tube-like object flank using the electrode body which provided the slit to the polar-plate group lower end part of a direct vent type lead storage battery, The detector circuit was provided between the terminal whose potential is lower than an electrode body insertion cell, and the electrode body terminal area, and the alarm was carried out as the case where the potential of an electrode body terminal area turns into a fall or non-potential from predetermined potential being unusual, and when higher than predetermined potential, it was made to display as normal.

[0010]

[Function]The sign of a dry rise of a direct vent type lead storage battery can be detected, and interception of the battery circuit by the dry rises rapidly generated during a run, such as an electromobile, can be beforehand prevented now.

[0011]

[Working example] Hereafter, this invention is explained based on an embodiment. Drawing 1 is a figure showing the electrode body used for this invention storage battery state detection device, and detects the existence of the isolation electrolysis solution in a battery. It is the figure where (b) provided the front view of the electrode body, (\*\*) provided the sectional view, and (\*\*) formed the lid in the electrode body lower part in the figure. In drawing 1, 1 is a metal stick, since regular negative potential is impressed, even if it is the metal of the arbitrary quality of the material, it is not corroded, but since there is possibility of corrosion when electrode body potential turns into non-potential before use, as the quality of the material of a metal stick, a lead or copper is suitable. When using copper, when \*\*\*\* is used, in order for an electrolysis solution to go up the crevice by capillarity and to make a terminal area corrode, a thing without crevices, such as a single fiber line, is used.

[0012] 2 is a tip exposed part of the metal stick 1, and makes this an electrode. 3 is a path cord linked to an other end exposed metal portion of the electrode 2 of the metal stick 1, and the tip is connected to a terminal area. When single fiber copper wire is used for the metal stick 1, if a lower end of single fiber copper wire is used as an electrode and the other end is made into a terminal area, the path cord 3 can be omitted, a welding part of the path cord 3 and the metal stick 1 is lost, disconnection by corrosion is lost, and it becomes a reliable electrode body.

[0013] 5 is insulating coating made of resin which carries out pre-insulation of the portion except the electrode 2 and a terminal area of the metal stick 1, and the tube-like object 6 which was united with insulating coating from a lower end peripheral part of the insulating coating 5 is made to hang, and it is made for the lower end to be located from a lower end of the electrode 2 in a downward position.

[0014] 7 is the slit provided in a lower end flank of the tube-like object 6, and enables it to contact the electrode 2 and an electrolysis solution in the tube-like object 6 through the slit 7. 8 is a sealing plug for electrode body fixation.

[0015] Drawing 2 shows an example of this invention storage battery state detection device which inserted an electrode body in the 5th cell from a cathode terminal of a 6 cell-configuration mono-block battery.

[0016] Although it comprises the light emitting diode 10A and the decrease flow resistance 10B, in the figure, 10 is the detector circuit provided between the electrode body terminal area 4 and the cathode terminal 9, and what is necessary is just a detector circuit which can display the existence of potential by contact with the isolation electrolysis solution of the electrode 2 circumference. In the figure, although the insertion cell of the electrode body has become the 5th from the cathode terminal 9, even if it inserts it in the 6th arbitrary cell from the 2nd, the same circuit composition of it is attained. As for \*\*\*\* and 13, in drawing 2, 11 is [ a valve portion and 15 ] connection levers a battery lid and 14 plates and 12 very much.

[0017]The electrolysis solution separated at the time of charge as the direct vent type lead storage battery was mentioned above goes up a gap with the plates 11 very much with the inner wall surface of \*\*\*\* 12. Although the ascending position of an electrolysis solution is different by composition of a battery, usually it goes up to the level of L1 shown in the figure by initial use - L3. In the battery by which an isolation electrolysis solution goes up to L1 - L2, in order to intercept a sealing reaction with the electrolysis solution between polar plates at the time of charge, some electrolysis solutions serve as gas, it is exhausted, and the amount of electrolysis solutions decreases gradually. The electrolysis solution which sealing reaction efficiency also became near 100% when the rise of an isolation electrolysis solution decreased to near the level of L3, the electrolysis solutions separated even if it was a battery of the end of life hardly decreased in number, and was separated for every charge appears.

[0018]However, by the battery group which connected the battery in series, even if the charger is operating normally with the capacity variation between batteries, excess voltage will be impressed to a battery with little capacity, and the suspension current of the maximum capacity of a charger will receive fault charge. In this case, generating gas volume exceeds the gas absorption capability of the negative pole far, and, as a result, disassembles and exhausts an electrolysis solution outside for a short period of time. Although the charging current in this case is usually about 0.1C-0.2C, Like an electromobile, in the time of a run and acceleration, the discharge current of 2-5C flows, and if a battery with little [ as mentioned above ] capacity exists, it will be exhausted out of a battery in the state of steam instead of hydrogen and the oxygen gas receive reverse charge, and the electrolysis solution between polar plates boils by generation of heat, and emitted in electrolysis.

[0019]The quantity of heat (the amount of electricity) by which exhaust air consumption is carried out in the state of steam has about 20 times as many differences by the water 1g per 0.539k calorie and 11k calorie by the quantity of heat by which exhaust air consumption is decomposed and carried out by electrolysis. As a result, it is L4 of drawing 2. If it does not exist while the isolation electrolysis solution of a grade charges, and it will be in a reverse charging state at the time of acceleration, in order to boil a battery in several minutes and to exhaust a part for a battery inland sea in the state of steam, with moisture between polar plates, it is checked that it will be in the state of a dry rise easily.

[0020]the electrolysis solution separated as such a state was shown in drawing 2 for preventing beforehand -- L -- it will become too late if an alarm is not taken out at the time to exist [ 4-about ].

[0021]Since the electrode 2 contacts the plates 11 very much and causes malfunction, the tubed voice 6 is made to hang from the lower end peripheral part of the pre-insulation 5, when the electrode body of drawing 2 is inserted very much in the gap part of the plates 11 and the wall surface in \*\*\*\* 12. An isolation electrolysis solution serves as a lower part from the

electrode 2, when a leak circuit is constituted for the plates 11 and the electrode 2 through the inner wall surface of the tube-like object 6, it will be decomposed by leakage current, moisture of the inner wall surface of the tube-like object 6 will be in a dry state in 1 to 2 minutes, and the plates 11 serve as the electrode 2 with letter-breaking-off-the-relation voice completely very much. Therefore, unless an isolation electrolysis solution contacts the electrode 2 directly, detection current does not flow. When the slit 7 of tube-like object 6 flank has an isolation electrolysis solution up from the electrode 2, If the incision part top end of the slit 7 does not have an interval of several millimeters from the lower end of the pre-insulation 5 as an electrolysis solution can be contacted through the slit 7, the drop of an electrolysis solution may adhere to the inner wall surface top end of the tube-like object 6, and this will cause malfunction.

[0022]When the lid 7A of the electrode body lower end part of (\*\*) of drawing 1 inserts an electrode body into a battery, it has prevented them from the textiles of a separator invading in the tube-like object 6, and causing malfunction.

[0023]

[Effect of the Invention]The battery became a dry rise, it intercepted the battery circuit and, in the case of the electromobile, it became impossible running it at the same time it could not detect the state of dry rise this side but the measuring instrument took out the alarm with the detecting method which measured the conventional internal resistance. However, according to this invention storage battery state detection device, the signs of a dry rise can be detected about one month ago, and a battery life can be sharply developed now by disposal of equalizing charge etc. A detector circuit becomes it is easy and easy [ a remote display ]

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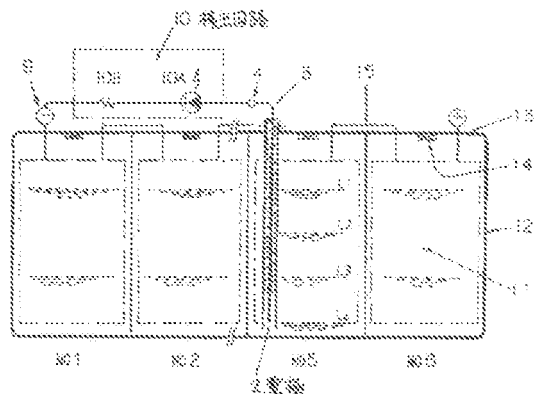
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(54) 【発明の名称】 蓄電池状態検出装置

(57) 【要約】

【目的】 回路が簡単で、遠隔表示もでき、事前にドライアップの電位を検出できる蓄電池状態検出装置を提供する。

【構成】 絶縁被覆された金属棒の先端露出部を電極、他端部を端了部として構成し、絶縁被覆先端外周面より絶縁被覆と連なる筒状体を電極を覆う位置まで垂下させ、この筒状体側部にフリットを設けた電極体を用い、この電極体を密閉式鉛蓄電池の極板群下端部まで挿入し、電極体挿入セルより電位の低い端子と電極体端子部との間に検出回路を設け、電極体端子部の電位が所定の電位より低下あるいは無電位となった場合異常として警報し、所定の電位より高い場合正常として表示するようにした蓄電池状態検出装置。



【特許請求の範囲】

【請求項1】 絶縁被覆された金属棒の先端露出部を電極、他端部を端子部として構成し、絶縁被覆先端外周部より絶縁被覆と連なる筒状体を電極を覆う位置まで垂下させ、前記筒状体側部にスリットを設けた電極体であって、前記電極体を密閉式鉛蓄電池の極板群下端部まで挿入し、電極体挿入セルより電位の低い端子と電極体端子部との間に検出回路を設け、電極体端子部の電位が所定の電位より低下あるいは無電位となった場合異常として警報し、所定の電位より高い場合正常として表示するよう

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は電気自動車など多数の密閉式鉛蓄電池（以下電池という）を直列接続して使用する用途での電池の異常を早期に検出する方法の改良に関するものである。

【0002】

【従来の技術とその課題】電気自動車のように多数の電池を直列に接続し群電池として使用する用途では、群電池内に1セルでも容量の少ない電池、あるいは故障した電池が発生すると、この電池が要因になって群電池の放電あるいは充電をも遮断する場合がある。

【0003】このような事故を未然に防止するため、電気自動車では電池の内部抵抗の推移を監視する装置を装備し、内部抵抗が規定値以上、つまり放電時あるいは充電時の電圧が規定値の範囲を越えたと警報を出し、電池故障を未然に防止するようにしている。

【0004】しかし電池の内部抵抗は、上昇傾向になると急激に上昇する性質があり、検出装置で異常を検出した時点で群電池の容量回復が困難であったり、また、電気自動車などでは警報確認とほぼ同時に路上走行ができなくなる故障が多発している。

【0005】

【課題を解決するための手段】本発明は、上述の従来の問題点を解決するための密閉式鉛蓄電池内の遊離電解液に着眼した。電池内のセパレータは隔離板であると同時に電解液保持板としての機能をもっている。装置、放電状態では遊離した電解液はほとんど存在しないものの、充電時には活物質間に発生したガスにより、活物質間に含まれる電解液を極板群エレメント外に吐出し、エレメントと電極内室との間隙部を上昇する。

【0006】この電解液の上昇は溢液を防止するため、過充電中であっても遊離した電解液がエレメント上端以上にならないように注液量を調整している。

【0007】しかし、この遊離した電解液が多量に存在する場合、極板間は液式電池と同じ性質となるため、充電時の発生ガスは液相により極板間に停滞するのを遮断され、陰極板でのガス吸収ができなくなり、発生ガスはガスの状態で外部に排気される。この結果、経年とともに

に遊離電解液は減少し、前記間隙部に残る遊離液は徐々に減少する。また、これにつれガス吸収効率が上昇するため、過充電時に外遊離液は確認できなくなる。

【0008】本発明は、充電中であっても極板間から遊離した電解液が検出しなくなると、電池の内部抵抗も上昇し容量も小さくなること、およびこの時点を経過すると過充電に耐えられなくなる前兆であることを見出したこと、また、この状態を検出し均等充電を実施すれば容量回復も可能であって、この時点を検出すれば急激な過充電によるドライアップで即座に放電回路が遮断されるような事故も発生しないことを見出したことに基づくものである。

【0009】すなわち、本発明蓄電池状態検出装置は金属棒先端および他端部以外を絶縁被覆し、先端部を電極、他端部を端子部として構成し、絶縁被覆先端外周部より絶縁被覆と連なる筒状体を電極を覆う位置まで垂下させ、この筒状体側部にスリットを設けた電極体を用い、この電極体を密閉式鉛蓄電池の極板群下端部まで挿入し、電極体挿入セルより電位の低い端子と電極体端子部との間に検出回路を設け、電極体端子部の電位が所定の電位より低下あるいは無電位となった場合異常として警報し、所定の電位より高い場合正常として表示するようにしたことを特徴とする。

【0010】

【作用】密閉式鉛蓄電池のドライアップの前兆を検出でき、電気自動車など走行中急激に発生するドライアップによる電池回路の遮断を未然に防止できるようになる。

【0011】

【実施例】以下、本発明を実施例に基づいて説明する。図1は本発明蓄電池状態検出装置に用いる電極体を示す図であって、電池内の遊離電解液の有無を検出する。図において（イ）は電極体の正面図、（ロ）はその断面図、（ハ）は電極体下部に銅を設けた図である。図1において、1は金属棒であって、常時負の電位が印加されるため、任意材質の金属であっても腐食されることはないが、使用前に電極体電位が無電位になる場合腐食の可能性があるので、金属棒の材質として白金か銅が適当である。また、銅を使用する場合、電解液を使用すると電解液が毛管現象でその隙間を上昇して端子部を腐食させるため単芯線などの糊接着のないものを用いる。

【0012】2は金属棒1の先端露出部であって、これを電極としている。3は金属棒1の電極2の端部金属露出部に被覆した被覆層であって、その先端は端子部に接続する。金属棒1に単芯銅線を使用した場合、単芯銅線の下端を電極、他端を端子部とすれば被覆層3が省略でき、接続線3と金属棒1との溶接部がなくなり、腐食による断線がなくなり信頼性の高い電極体となる。

【0013】4は金属棒1の電極2と端子部を除いた部分を遊離被覆する樹脂製絶縁被覆膜であって、その絶縁被覆膜5の下端外周部より絶縁被覆と一体となった筒状体ら



を低下させ、その下端は電極2の下端より下方の位置にあるようにする。

【0014】7は筒状体6の下端側部に設けたスリットで、スリット7を通し筒状体6内の電極2と電解液が接触できるようにしている。8は電極体固定用密封栓である。

【0015】図3は6セル構成モノブロック電池の負極端子より第5番目セルに電極体を挿入した本発明電池状態検出装置の一例を示すものである。

【0016】同図において10は電極体端子部4と負極端子9との間に設けた検出回路であって、発光ダイオード10Aと抵抗抵抗10Bとで構成されているが、電極2周辺の遊離電解液との接触により電位の有無が表示される検出回路であればよい。また、同図では電極体の挿入セルは負極端子9より第5番目となっているが第2番目より第4番目の任意のセルに挿入しても同様の回路構成が可能となる。図2において11は極板群、12は電極、13は電池蓋、14は弁部、15は検電杆である。

【0017】密封式鉛蓄電池は前述したように充電時には遊離した電解液が電極12の内壁面と極板群11との間隙を上昇する。電池の構成により電解液の上昇位置は相違するが、使用初期では同図に示すL1～L3のレベルまで上昇するのが普通である。L1～L3まで遊離電解液が上昇する電池では、充電時極板間の電解液で密閉反応を遊離するため、電解液の一部はガスとなって排気され、電解液量は徐々に減少する。遊離電解液の上昇がL3のレベル近くまで減少すると密閉反応効率も100%近くなり、寿命末期の電池であっても遊離した電解液はほとんど減少することなく充電毎に遊離した電解液が現れる。

【0018】しかし、電池を直列に接続した電池群では電池間の容量バラツキでたとえ充電器が正常に動作していても、容量の少ない電池に過電圧が印加され、充電器の最大容量の垂直電流で過充電を受ける。この場合、発生ガス量は腔移のガス吸収能力をなすかに越え、この結果短時間で電解液を分解、外部に排気する。この場合の充電電流は通常より、1C～2C程度であるが、電気自動車のように走行、加速時などでは2～5Cの放電電流が流れ、前述のように容量の少ない電池が存在すると過充電を受け発熱により極板間の電解液が沸騰し電気分解で発生する水素・酸素ガスを多く、水素ガスの状態で電池外に排気される。

【0019】水素ガスの状態で排気消耗される熱量（電気量）は電気分解で分解され排気消耗される熱量とでは水1g当り0.539kcalのリーと11kcalのリーで約20倍もの相違がある。この結果図2のL4程度の遊離電解液が充電中に存在しないと、加速時、過充電状態になれば極板間の水分は数分間で電池は沸騰し、電池内水分を水素ガスの状態で排気するため、容易にドライアップの状態になることが確認されている。

【0020】このような状態を未然に防止するには図2に示すように遊離した電解液がしき度存在する時期に警報を出さないと手遅れになる。

【0021】図2の電極体は極板群11と電極12内壁面との接隙部に挿入した場合、電極2が極板群11と接触し、誤動作の原因になるため絶縁被覆5の下端外周部より筒状体6は低下させている。また、遊離電解液が電極2より下方となり、極板群11と電極2とが筒状体6の内壁面を通しリーク回路が構成された場合、筒状体6の内壁面の水分はリーク電流により分解され、1～2分後には乾燥状態となって電極2と極板群11とは完全に絶縁状態となる。よって遊離電解液が直接電極2に接触しない限り検出電流は減れることはない。筒状体6側部のスリット7は遊離電解液が電極2より上方にある場合、スリット7を通し電解液と接触できるようにしたものであって、また、スリット7の切開部上端は絶縁被覆5の下端より数mmの間隔がないと電解液の滴が筒状体6の内壁面上端部に付着する可能性があって、これが誤動作の原因となる。

【0022】図1の（ハ）の電極体下端部より蓋7Aは、電極体を電池内に挿入する際、セパレータの導線が筒状体6内に侵入して誤動作の原因になるのを防止している。

【0023】

【発明の効果】従来の内部抵抗を測定した検出法ではドライアップ手前の状態が検出できず、測定器が警報を出したと同時に電池はドライアップになり電池回路を遮断し、電気自動車の場合走行不能となった。しかし本発明電池状態検出装置によれば、約1ヶ月前にドライアップの兆候を検出でき、過充電などの措置により電池寿命を大幅に伸ばすことができるようになった。また、検出回路が簡単で、遠隔表示も簡単となる。

【図面の簡単な説明】

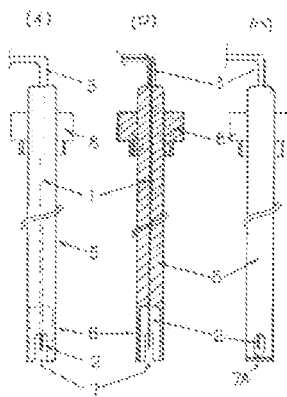
【図1】本発明電池状態検出装置の電極体を示した図

【図2】本発明電池状態検出装置の一例を示した図

【符号の説明】

- 1 金属棒
- 2 電極
- 3 リード線
- 4 端子
- 5 絶縁被覆
- 6 筒状体
- 7 スリット
- 8 電極体固定用密封栓
- 9 負極端子
- 10 検出回路
- 10A 発光ダイオード
- 10B 抵抗抵抗
- 11 極板群
- 12 電極

【図1】



【図2】

